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Saccharide-based Approach to Green Metallic Nanostructure Synthesis

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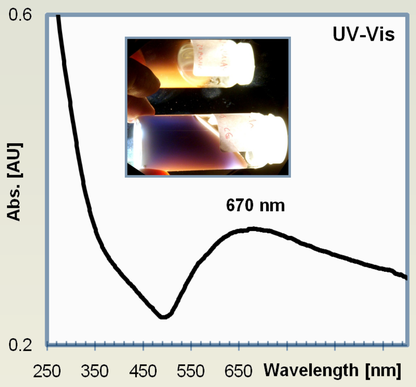
A green approach to solution synthesis of metallic nanoparticles has been developed using harmless and bioapplicable chemicals as well as moderate temperatures.

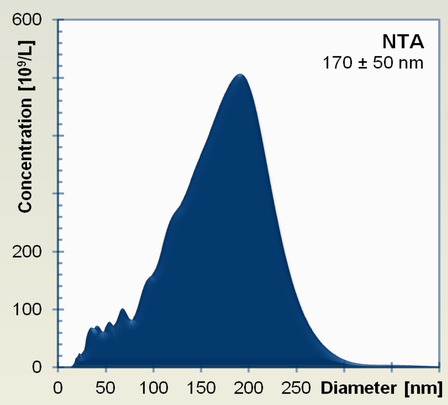
Metal precursors are reduced by glucose/buffers and sterically stabilized by starch. The saccharide based procedure is highly diverse producing specifically a wide range of spherical, anisotropic, metallic, semi-conductor and core-shell nanostructures.

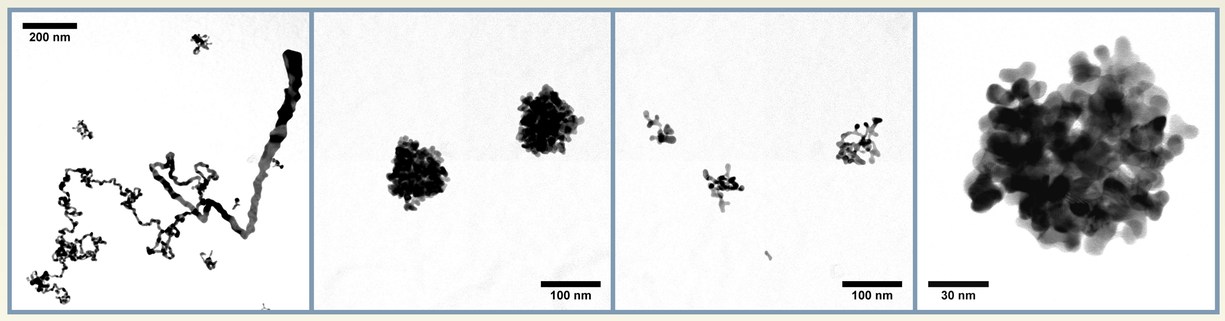
NOVEL TYPE ANISOTROPIC METALLIC NANOSTRUCTURES



GOLD NANO-DENDRITES

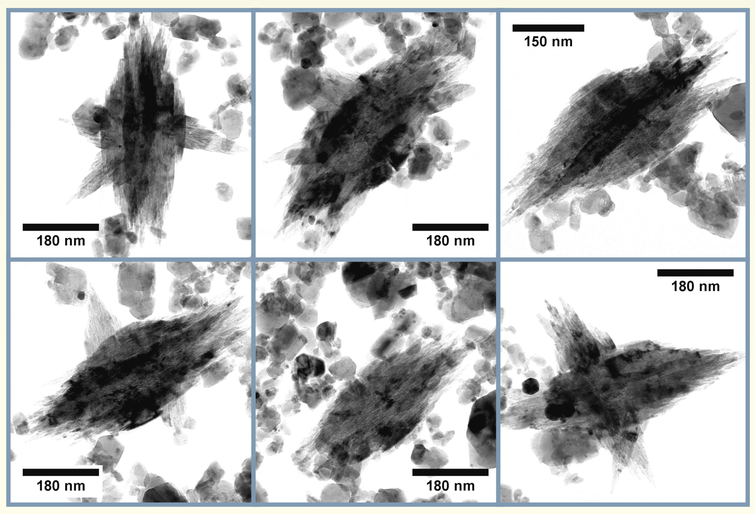
Dendritic/porous nano-structures of gold are prepared by slow reduction/ growth. The structures are 100-200 nm in diameter with a very large surface area.

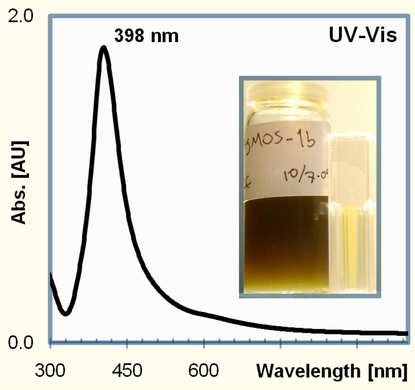




CUPRIC OXIDE NANOSHUTTLES

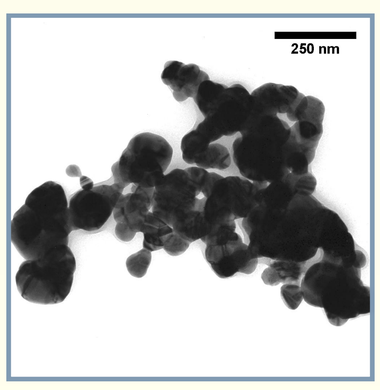
Clusters of crystalline bundles of needle-shaped CuO as well as cubic CuO NPs are obtained.



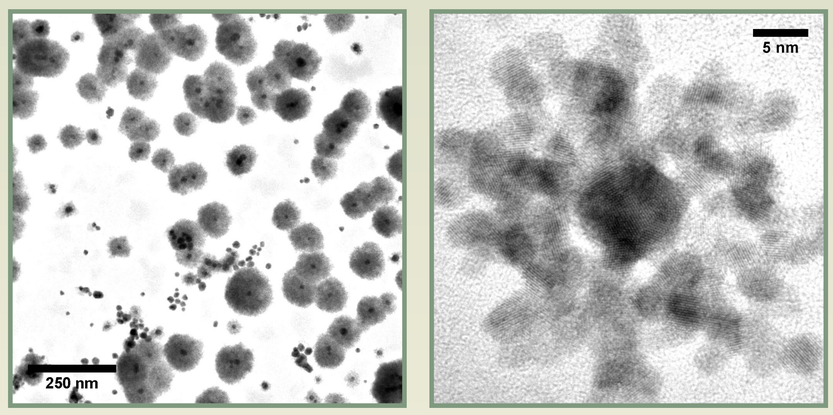


SILVER NANO-CLUSTERS

Clusters of sintered, polydisperse, spherical silver nano-particles are prepared.



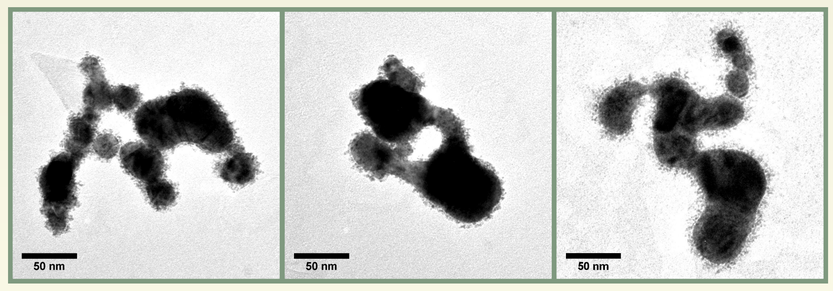
CORE-SHELL NANOSTRUCTURES



BIMETALLIC *NANOFLOWERS*

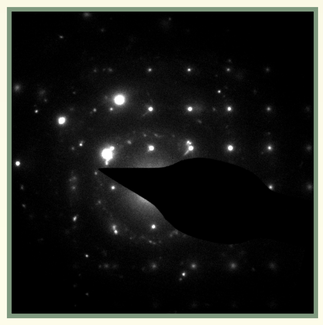
A shell of controlable thickness consisting of many individual, single-crystal PtNPs (≈ 2 nm) immobilized in a starch scaffold can be formed around single AuNP cores of varying size. The structures present a very large accessible Pt surface area.

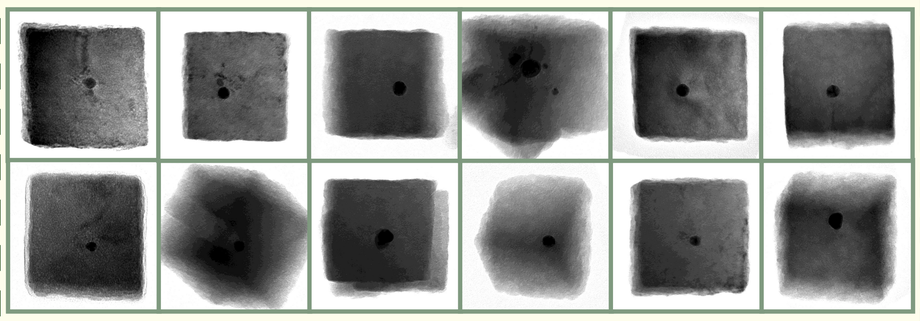
Such shells can also be formed around anisotropic gold nanostructures and aggregates.

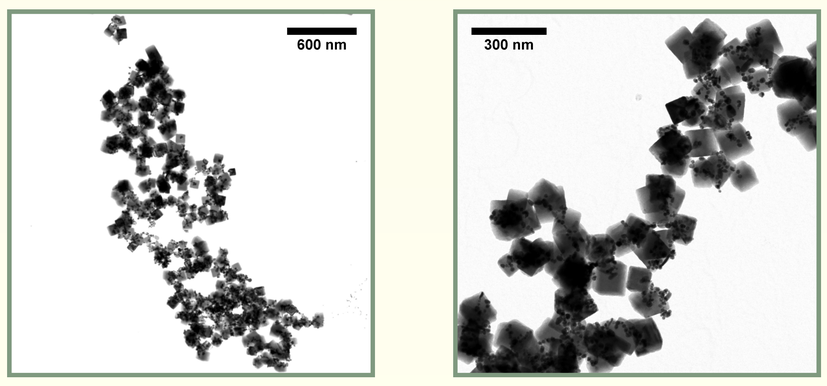


CUPROUS OXIDE NANOCUBES

Monodisperse cubic Cu_2O shells can be formed around single AuNP cores. The 100-200 nm structures are formed directly on the TEM copper grid. The TEM micrographs of single cubes shown below all measure 150x150 nm^2.



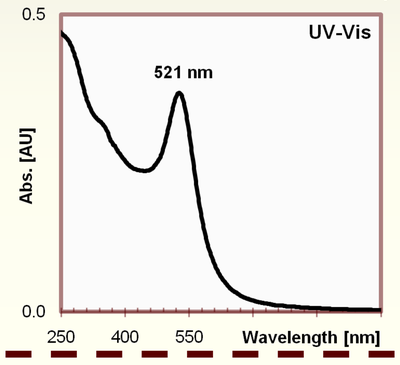


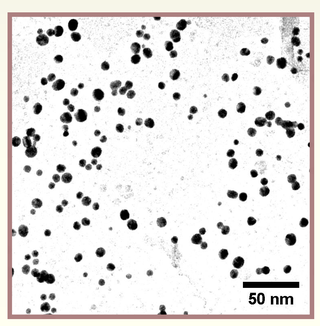


SPHERICAL METALLIC NANOPARTICLES

GOLD NANOPARTICLES

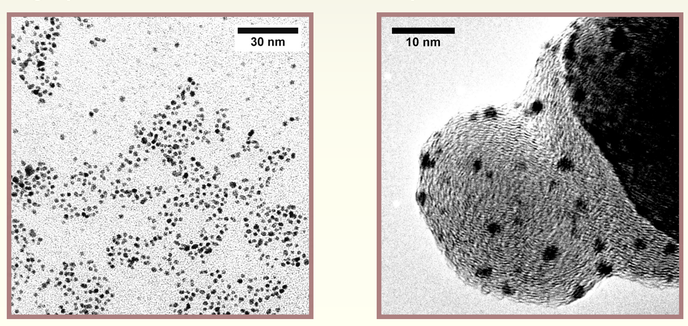
8 ± 2 nm spherical AuNPs are prepared at room temperature in 15 min by one particular green procedure. The colloidal solution is stable for several years.





PLATINUM NANOPARTICLES

1.7 ± 0.2 nm single-crystal spherical PtNPs can also be prepared. The PtNPs can be loaded on carbon for use in highly efficient fuel cell electrocatalysis.



WE ARE VERY OPEN TO COLLABORATION IF ANY OF THESE STRUCTURES ARE OF INTEREST TO YOUR RESEARCH.

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We greatly appreciate the assistance from DTU CEN and Thomas W. Hansen, Jakob B. Wagner, Chris Boothroyd and Andrew Burrows.